will take up much more room in the former than in the latter position, of which the width of the barge will not always admit. The model sent is applicable in either way.

PHILIP LUCAS, Jun.

Oct. 12, 1843.

No. II.

CHIMES FOR HOUSE-CLOCKS.

The SILVER ISIS MEDAL was presented to A. E. BRAE, Esq. of Leeds, for his improved Chimes for House-Clocks.

THERE are few persons so ignorant of the internal construction of a common house-clock as not to know that when it strikes the hours it does so by the aid of a distinct and separate train of wheel-work, the weight, or spring of which requires to be wound up in the same manner as that by which the hands are moved round the dial. But, owing to the comparative rareness with which clocks that chime the quarters are seen, it is by no means so well, or so generally known, that when *they* do so, it is by the aid of a *third* train of wheel-work distinct and separate from the two former, having, like them, a separate weight, or spring, requiring to be wound up at intervals.

It is not easy, without entering into a minute description of the mechanism that regulates the striking part of a clock, to give a familiar reason why this third train should be necessary in order to strike the quarters; but, since it is extremely desirable that the nature of the difficulty should be understood in order that the improve-

ment to be hereafter described may be appreciated, the following explanation is attempted.

As, in the course of twelve hours, the striking-bell of an ordinary clock is sounded seventy-eight times, it may be supposed that, for that purpose, its striking-wheel may be set round with seventy-eight pegs, each of which, raising the hammer once, would cause one stroke; but a wheel, capable of containing so great a number of pegs, would be of a most inconvenient size, and if, in addition to the hour pegs, those for the quarters were also to be inserted, then the wheel would require to be of such an enormous size as to be wholly out of the question.

In *practice* so long as one bell only is required, the number of the pegs may be, and is, greatly reduced by causing the same pegs to serve over and over again; since each peg, having to actuate the same bell as its fellows, may be indifferently used in any part of the performance. But where the quarters are to be announced in combination with the hours, the result is different; for, in that case, more than one bell being necessary for distinction's sake, it is no longer possible to use the pegs indiscriminately, nor is any abridgment of their number practicable. Hence two separate trains have hitherto been considered indispensable, in order that the two operations of striking the hours and of chiming the quarters might be kept distinct.

The evils and inconvenience attending two trains must be obvious.

First, from the increase of size, mechanism, and consequent cost of the clock.

Secondly, from the impracticability of adapting the accompaniment of chimes to any clock but such as had been, *ab initio*, designed for the purpose.

It was principally from a desire of overcoming this last apparent difficulty in behalf of a favourite old house-clock, that the experiment, the result of which is now before the Honourable Society of Arts, was undertaken; and, complete success having attended it, it is chiefly in the hope of rescuing it from obscurity that it is submitted as an object for the Society's valuable approbation.

The principle upon which the improvement has been effected is that of *repetition*. Were the barrel, round which the pegs are placed, to be in fixed connexion with its wheel (as is usually the case), then no repetition of the same pegs could take place until an entire revolution had been effected. But an entire revolution must occupy twelve hours, since in no less interval of time could precisely similar numbers of hour and quarter strokes again occur; whence would arise the necessity (as has been before explained) of an enormous size of barrel, to enable it to contain all the pegs necessary for twelve hours.

For example, let it be supposed that the hour and quarter strokes for the first hour were to require altogether five pegs, and that such five pegs occupied an entire revolution of the barrel, then the revolution of the barrel and the striking of the first hour and quarters would end simultaneously, and the barrel would be again in the proper situation to commence the quarters for the second hour. But at the end of the second hour a like result could not ensue; because the second hour, requiring one more stroke than the first, would carry the barrel *beyond* the proper position for the commencement of the third hour, so that inextricable confusion must arise.

But if it be supposed that the barrel, after having completed the striking of any hour or quarter, instead

of remaining fixed to its wheel, could be disconnected, and allowed to fall back to its initial position, there to be thrown into connexion with its wheel again, it is plain that by resting against an initial stop it would always be in a correct position to recommence at the proper point, provided that no one operation should exceed a complete revolution. Were this effected the greatest number of pegs required would obviously be only those necessary for the complete chiming and striking of the twelfth or longest hour.

Such being the theory of the improvement, it remains to be shewn in what manner it has been reduced to practice, the great difficulty having been to provide an available power, by which the barrel might be thrown in and out of gear without unduly loading the going part of the clock. That such a condition has been fulfilled is best proved by the fact that after the improvement was applied to the clock exhibited before the Committee of Mechanics, its rate of going remained precisely the same as before.

The clock in question is a forty-day clock, made by the well-known George Graham, its age being at least a century. It was constructed with the old fashioned count-wheel and locking-plate, which rendered its alteration much more difficult than would have been the case had its striking part been of the modern construction. The letters of reference in the following description refer to figs. 1, 2, 3, and 4, plate 1.

The numbers of the striking train are as follows:—

Great wheel *a*	108		
Second or pin-wheel *b*	78	8	pinion
Hoop, or tumbler *c*	70	6	—
Fly-wheel *d*	54	6	—
Fly-pinion *e*		6	—

The only additions to which have been, first, a barrel-wheel of seventy teeth pitching in with the old pin-wheel *b*; and, secondly, the alteration of the hoop-wheel *c* into a tumbling-wheel of two gathering leaves.

The arbor of the barrel-wheel is of sufficient length and strength to receive the barrel *g*, which last is not *fixed* upon it, but is capable of revolving freely upon its centers. These centers, with the barrel, are also capable of a short sliding motion from side to side, in the direction of its length, for the purpose of moving in and out of gear. The wheel itself is fixed permanently upon the arbor, and is pitched, by proper supports, to work in with the old pin-wheel *b*.

Of its 70 teeth, 63 are the most that require to be run off at any operation; so that the barrel-wheel cannot be required to make an entire revolution at any one time. These 63 teeth are thus apportioned, viz.:—

3 at the commencement of each operation, for the purpose of winding up a remontoir spring, the use of which will be hereafter explained.

24, being six each for the four quarters.

36, being three for each stroke of the longest, or twelfth hour; making altogether 63.

On the back-plate of the clock is fixed a rack *h*, of 21 acting teeth, each of which corresponds with three of the barrel-wheel teeth. This rack is stopped, in the usual manner, by a tail-pin *i*, and snail *j*; and, according to the number of rack-teeth left to be gathered up by the tumbler leaves, so many teeth of the barrel-wheel will be run off: thus, if three of the rack-teeth fall back, nine of the barrel-teeth come into action, being sufficient for the first quarter; that is to say, three for the remontoir, and six for the quarter. In like manner,

five rack-teeth are necessary for the half-hour, seven for the three-quarters, and nine for the four quarters, together with one for each stroke of the hour that follows; twenty-one being the maximum.

The snail *j* may be next described. It is, of course, much larger than when intended for hours only, since it has to be divided into forty-eight steps instead of twelve. It assumes a singular and highly ornamental shape, as may be seen by reference to fig. 2 in the accompanying plate.

According to whichever of its forty-eight steps the snail presents to the tail-pin of the rack, so far is the rack permitted to fall back, and consequently so many of its teeth remain to be gathered up. The steel arbor, to which the snail is fixed, is of sufficient length to pass from back to front of the clock, where it bears, upon its other extremity a light wheel of forty-eight teeth, one of which being acted upon by the dial-wheels of the clock once in every quarter of an hour, the motion is transmitted to the snail, which thus presents a different step in each successive fifteen minutes.

It now becomes necessary to describe the manner in which the barrel is acted upon so as to be thrown in and out of gear during each operation.

It has been stated, that the barrel *g* is capable of motion lengthwise upon its axis, so that it may be pushed close to, or drawn away from, its wheel *f*. At the extremity of the barrel is a spring detent *k*, shewn in fig. 3, capable of locking into any one of the spaces between the teeth of the barrel-wheel *f*; and on the further side of the said wheel is fixed a circular plate *l*, fig. 4, of similar diameter, and in near parallelism with it, forming a guide and a support for the detent *k*. This circular

plate, being bevelled on its outer edge, admits of the fall of the detent so as to lock into the wheel; but upon the barrel being moved away from the wheel, the inclined nose of the detent slides up the bevelled edge, until, having dropped over into the space between the wheel and the circular plate, it is there confined against the unbevelled edge which detains it out of gear, leaving the barrel in perfect freedom to return, by the gravity of a small weight *m*, figs. 1 to 4, to its initial position; here the nose of the detent becomes opposite to an opening or notch in the circular plate *l*, which therefore no longer opposes the return of the barrel into lockage again.

To effect the motion of the barrel to and fro, it is surrounded, in a convenient situation, by a thin flange *n*, fig. 4, which, standing out from the barrel, is grasped by a forked lever *o*, fig. 4, which presents no hindrance to its *circular* motion, but by which *lateral* motion may be communicated to it at any point in its circumference.

To move the barrel *into* lockage by means of this lever is the office of the remontoir spring *p*, fig. 1, before alluded to; it acts against a three-armed piece *q*, which, being sent back and secured behind a latch-detent *rr*, fig. 1, by the first effort of the train, remains in readiness to pull the arm *s*, and so move the lever *o*, by its reaction, when set free by the motion of the clock shortly before each quarter. For the opposite motion of throwing the barrel *out* of gear, advantage is taken of the momentum acquired by the train of wheels when in full action. This momentum, which exerts considerable force, is, in ordinary clocks, expended against a dead stop, which falls before a pin in one of the wheels when their duty for the time has been completed.

Instead of such dead stopping of the momentum, it is,

in this improvement, allowed to impinge against a spring-stop *t*, fig. 1, similar to the buffer of a railway-carriage, which it drives in against another arm *u*, of the forked lever *o*, fig. 4, by which means ample force for the movement of the barrel is obtained.

Near to the further end of the barrel is a groove, in which there lies a fine silk thread, at the extremity of which is the small weight *m*, figs. 1, 4; by this means the barrel, when set free, is immediately drawn back to its initial point. A weight has been chosen, for the purpose of bringing back the barrel, in preference to a spring, because the former exerts an equal force at any point in the circumference, which would not be the case with a spring.

Explanation of the Drawings, Plate 1, *Figs.* 1, 2, 3, 4.

Fig. 1 comprises the striking-train of the clock, together with the *added* portions; *a*, *b*, *c*, *d*, are the wheels of the old train, whereof *b* is the pin-wheel, *e* the fly, *f* the barrel-wheel, *g* the barrel; *q*, a three-armed piece, whereof one arm is acted upon by the spring *p*, another by the pins of the old pin-wheel *b*, and the third is connected by the link *v* with the arm *s*, fig. 4. The piece *q*, having been set back in opposition to the spring *p*, by the motion of the pin-wheel, is secured behind the detent *r r*, which, being released by the dial-work, permits the reaction of the spring *p* to draw in the arm *s*, fig. 4. *t*, the spring-stop, the end of which impinges against *u*, fig. 4; *w*, the hawk's-bill detent, working in the teeth of the rack *h*, whereof *i* is the tail-pin; *j*, a portion of the snail, the whole of which is shewn smaller in fig. 2; the dotted lines indicate that such portions are behind the plate;

x, the chiming-bells and hammer-frame, placed upon a spare portion of the seat-board; *p*, the former striking-spring, now used as a remontoir for the piece *q*.

Fig. 2 represents the snail, whereof the deep spaces are the hours and last quarter; the shallow steps are for the first, second, and third quarters respectively.

Fig. 3, one end of the barrel with its centering, detent, and striking-pegs in profile.

Fig. 4, the barrel with its parts, viz. *s* and *u*, the lever arms; *n*, the flange; *o*, the forked arm of lever; *k*, the detent; *l*, guide-plate; *y*, groove for weight; *f*, barrel-wheel.

P. S. Subsequently to the foregoing improvement having been submitted to, and approved of by, the Society of Arts, it has appeared to the inventor to be liable to two objections, until the removal of which it could not be intrusted into general use. The first is, that should it so happen that the weight of the striking-train be grounded or run down, while the tail-pin of the rack should still be engaged in any of the spaces of the snail, then, not only the striking part, but the going part also of the clock must come to a stand, on account of the snail being blocked by the rack; and, should any attempt be then made to move on the hands, there would be great risk of the works being strained or broken. The second is, the great number of strokes that should be waited for in the operation of what is commonly called "setting the clock."

It is true that ordinary clocks are all, more or less, open to the same objections; but in one constructed or altered according to the principles laid down in the foregoing description, such objections are greatly magnified on two accounts. First, because in a clock altered from

the ordinary construction, the striking-train, from the great increase in its work, must necessarily run down in a much shorter time than before, while the movement-train preserves its full duration. For example, in the clock produced before the Society the duration of the striking-train is reduced to one-fourth of that of the movement-train. This would, in itself, be attended with no evil or inconvenience, provided it did not interfere with the duration of the dial-train, since a short cessation from striking does no great harm, while it soon leads attention to its own wants. Secondly, because the striking occurring every quarter, instead of every hour, not only greatly increases the tediousness of waiting for a round of striking, but also is in much greater danger of being overrun by a careless person, to the certain injury of the works.

Both objections have been met and completely remedied by the addition of a very simple and easily applied strike-silent-piece, which is thrown into action by the cord of the weight shortly before being run down; so that the first objection is obviated by a self-acting prevention, while the second may also be obviated by the person who has to adjust the clock, moving (through the quarter of a circle from "strike" to "silent") a small index which appears through the face of the dial. No further striking can then ensue until, upon the completion of the operation, the index is replaced at "strike."

A. E. Brae.

Leeds, Nov. 1843.